island) and Japan. The land-planarians of the Australian and neotropical regions are alike in one striking feature. The family Geoplanidæ is practically divided between them. The neotropical members of the genus *Geoplana* include most of the flattened primitive ones, and also peculiar forms such as *Leimacopsis* and *Polycladus*. Von Graff goes so far as to share the opinion that this geoplanid fauna has arisen on a lost Antarctic continent, and has spread on the one hand to New Zealand and Australia, on the other to South America. The distribution of earthworms lends strong support to this view, as Mr. Beddard has shown.

The concluding section of the work is composed of full systematic descriptions of the families, genera and species. Von Graff makes five families: the Limacopsidæ, with two tentacles; the Cotyloplanidæ (an unnatural family), with suckers; the Geoplanidæ, with scattered eyes; the Bipaliidæ, with the eyes limited to the flattened "head"; and the Rhynchodemidæ, with a pair of large eyes. There are now nineteen genera, many of which are new.

This monograph will be of inestimable value to all naturalists interested in land-planarians, and the author is to be congratulated on having completed such a laborious task with unfailing accuracy. The lithographers and publishers deserve a special word of praise for the beautiful plates and printing which adorn this book.

F. W. GAMBLE.

A SCIENTIFIC ENGINEER.

Papers on Mechanical and Physical Subjects. By Osborne Reynolds, F.R.S. Vol. i. Pp. xv + 416. (Cambridge: University Press, 1900.)

THE Cambridge University Press has during some years past contributed very largely to the progress of physical science by the issue of the collected works of great mathematicians and physicists. The volumes which contain the collected writings of Maxwell, Adams and Cayley form a rich storehouse of knowledge; and the efforts the Press has made to induce living writers, such as Kelvin, Stokes and Rayleigh, to edit their own papers for issue in a collected form deserve the gratitude of all students.

Among the latest of such reprints is the volume before us. Its author, Prof. Osborne Reynolds, has passed a busy life as a teacher in a great commercial and manufacturing city, and his collected papers testify to the breadth of his interests and the wide scope of his work.

The papers included in the present volume, some forty in number, were published between 1869 and 1882. They range over a great variety of subjects, from the tails of comets and the solar corona to problems connected with the steering of ships and the bursting of guns. In so varied a collection the relative importance of the different papers differs greatly, and yet all are interesting; and all have advanced the sum of human knowledge.

Indeed, on reading them, one cannot help regretting that the author's interests have been so widely diffused, and that he has not had the opportunity of concentrating himself on some one or other of the great engineering problems which await solution, applying to it his practical experience and insight and his mathematical skill.

An extract from the author's preface makes the cause of this clear. He writes:

"As affording some explanation of the absence of any connection between many of the subjects in this collection of papers, it may be pointed out that these subjects have not been determined by arbitrary selection, neither have they been the result of following up one line of research. They have for the most part been suggested by the discrepancies between the results obtained in definite mechanical arrangements, such as occur in some parts of the large field of practical mechanics, and the conclusions arrived at as to what those results should be for the same circumstances, by means of geometrical and physical analysis, as far as this analysis was developed at the time."

But to turn to the matter of the papers; it would take too long to attempt to analyse them all; and, indeed, the results of the most important are now classic, *e.g.* those on the refraction of sound, the action of a screw propeller, the steering of screw steamers, and the explanation of the radiometer.

The two papers on the refraction of sound are numbered 16 and 22. Stokes had, seventeen years before the date of the first of these papers, suggested the reason why sounds are heard less distinctly against the wind than with it. It is due to the fact that the velocity of the wind rises as we ascend; hence when a sound-wave is travelling against the wind, the wave-velocity is less in the upper portion of the wave than in the lower; thus the wave-front is bent upwards, and the sound passes over the head of the observer. The same notion occurred to Reynolds; he verified it by direct experiment, and pointed out, moreover, that in ordinary conditions of the atmosphere the temperature falls as we ascend; hence from this cause also the wave-velocity is reduced, and the path of the sound is no longer straight, but curved, with the convexity of the curve turned downwards. If, however, it should happen that the air is warmer above than it is below, the reverse will be the case—the sound-waves will be bent downwards—the sound will thus be audible at a greater distance than previously.

The papers on the action of the screw propeller form an interesting series. The racing of a screw is proved to be due to the admission of air to the screw; this, it is shown, interferes with the power of the screw to obtain water, and also reduces the resistance which would otherwise be offered by the water the screw would get For consider a vertical plate, totally immersed in water, which is being pushed forward; its speed may be such that the water behind cannot remain continuously in contact with it. A vacuum will tend to form behind the plate; the limiting velocity at which this takes place will depend on the pressure in the water behind the plate; if no air can reach the plate, this pressure will be the atmospheric pressure, together with that due to the depth of water above the plate; if air can reach the space behind the plate, the limiting velocity will depend only on the pressure due to the water, and will be much less than in the first case. The blades of the propeller act like the plate; a stationary screw will be most effective in propelling water when it is turning so fast that a vacuum is just formed behind its floats, and the rate at which the water is driven past depends on the water pressure just close to the floats; if air can reach the floats,

no vacuum can be formed; the pressure will depend only on the height of the column of water above the screw; the limiting velocity will be less than when the screw remained free from air.

The steering of screw steamers is dealt with in several papers laid before the British Association; three of these are reports of a committee appointed in 1875 to investigate the question. Of this committee Prof. Reynolds was secretary. Briefly, their researches confirm the theory he had advanced in a paper published in the *Engineer*, June 4, 1875, explaining the accident to the steamer *Bessemer*, which had failed to enter Calais Harbour on May 8 previously.

Prof. Reynolds pointed out

"when a ship is stopping, the water will be following her stern relatively faster than when she is moving uniformly, and consequently that the effect on the rudder will be diminished; that the longer the ship the greater will be this difference; also that this effect is greatly increased when a ship is stopping herself with her propellers, as was the *Bessemer*, for since not only is the retardation of the vessel much more rapid, but the water has a forward motion imparted to it by the propellers, which motion, if the propellers are near the rudder, may be greater than that of the ship, in which circumstance the effect of her rudder's action will be reversed."

In the paper on the radiometer, "On the Forces caused by Evaporation from, and Condensation at, a Surface," the true explanation of its action is given in the concluding paragraphs. The paper deals in the main with the effects of evaporation and condensation in causing motion, but near the end the author writes:

"Since writing the above paper, it has occurred to me that, according to the kinetic theory, a somewhat similar effect to that of evaporation must result whenever heat is communicated from a hot surface to a gas. The particles which impinge on the surface will rebound with a greater velocity than that with which they approached, and consequently the effect of the blow must be greater than it would have been had the surface been of the same temperature as the gas."

The longest paper in the collection is that on certain dimensional properties of matter in the gaseous state; it contains the results of a number of experiments on the thermal transpiration of gases through porous plates, and an extension of the dynamical theory to account for the phenomena.

Enough has been said, perhaps, to show the interest of the volume and the importance of the scientific results it contains. It is got up in the admirable manner which characterises the Pitt Press productions, and in form leaves nothing to be desired.

COUNT SCHEIBLER'S SPORTING TOUR.

Sette Anni di Caccia Grossa é Note di Viaggio in America, Asia, Africa, Europa. By Count Felice Scheibler. Pp. xv + 525. Illustrated. (Milan: U. Hoepli, 1900.)

ENGLISHMEN are, perhaps, somewhat too inclined to believe that great game shooting is a special prerogative of the Anglo-Saxon; but the publication of the present work, together with the recently issued English translation of Count Potocki's "Sport in Somaliland," should do something to dissipate this mistaken notion. Count Felice Scheibler may, indeed, be said to be a "mighty hunter," and the frequent mention of his name in Mr. Rowland Ward's "Records of Big Game" will suffice to show that many of the animals that fell to his rifle have yielded trophies of more than usual size. As is indicated in the title of the volume before us, the author's seven years' hunting included experiences of the great game of all the four continents of the world although in Asia his travels were limited to India and Ceylon, and in America to the United States and the Dominion of Canada. A well written and well illustrated record of such extensive experiences could not fail to be of interest, not only to his brother sportsmen, but likewise to naturalists; and the present volume may be truthfully said to fulfil both these conditions. The 250 text-figures with which the work is embellished are for the most part reproductions from photographs taken respectively by the author, Prince di Teano, and Mr. Seton Karr, and are remarkable alike for the manner in which they have been executed and the care with which they have been printed. A large number of these illustrations deal with animals which were shot by the Count, and although most of these were taken after death, yet they frequently portray very clearly some of the more striking characteristics of the particular species. The views of scenery and hunting scenes are, moreover, specially good, and will give to stay-at-home readers an excellent idea of the nature of the districts in which sport was obtained, and of the mode in which various animals are hunted. Of especial interest is the photograph, on p. 176, of recently captured elephants crowded into a *kedda*, while those representing the elephant tamers at work are scarcely less attractive. Some of the titles to the illustrations, such as "Il bufalo record," are perhaps a little comic, but Italian, like French, has not yet evolved a sporting language of its own.

Although the author does not appear to have had the good fortune to discover any new species, his accounts of the habits of many of the less known forms will be found of considerable interest to the naturalist. And a gratifying feature is the attention paid to nomenclature, since this is a point in which sporting works are apt to be very deficient. In the employment of names like *Mazama columbiana* for the Columbian black-tailed deer, and *Taurotragus oryx* for the eland, the Count is, indeed, thoroughly up-to-date and ahead of most works on popular natural history.

Whether, however, the author confined his love for shooting within such limits as would meet with the approval of the recent congress on the preservation of great game is a question which may be left for others to answer. But the plate on p. 457, which represents three individuals of the common African rhinoceros, out of a herd of six, already fallen, while aim is being taken by the author at a fourth, is calculated to give rise to misgivings on this point.

Starting from Liverpool in 1889, Count Scheibler sailed for America, where he soon enjoyed excellent sport in the Rocky Mountains with "grizzly" and wapiti; afterwards proceeding to British Columbia, where he was successful in obtaining examples of the Rocky Mountain goat. At San Francisco he embarked for India, where